apples, by J. C. ARTHUR ; Additions to the flora of Indiana, and Some midsummer plants of southeastern Tennessee, by STANLEY COULTER ; A bacterial disease of tomatoes, by WILLIAM STUART ; Description of certain bacteria obtained from nodules of various leguminous plants, by SEVERANCE BURRAGE ; Mycological notes from Wells and Whitley counties, by E. B. WILLIAMSON.— J. M. C.

NOTES FOR STUDENTS.

JOST[6] has published an interesting and valuable summary of the recent contributions to our knowledge of the synthesis of proteids. Recent workers generally agree, in contrast with the older view of Schimper, that proteid synthesis can take place in the dark and in tissues without chlorophyll, provided carbohydrates are at hand.— H. C. COWLES.

F. E. WEISS,[7] after examining a very large number of specimens of Lepidophloios and Lepidodendron, has concluded that the arrangement of the cells making up the phloem region, at least as seen in transverse section, not only does not preclude them from being of the nature of true phloem elements, but makes it very probable that the function of this tissue was that of a normal phloem.—J. M. C.

BENJAMIN D. GILBERT[8] has published a useful list of North American pteridophytes. According to the editor, the four objects in view were (1) to present a convenient alphabetical list ; (2) to make a list as comprehensive as possible in including all published forms ; (3) to have a complete list which uses a conservative nomenclature ; and (4) to publish the list of varieties of *Athyrium filix-foemina* which the author has found.—J. M. C.

J. W. HARSHBERGER[9] has been investigating the limits of variation in certain plants by the statistical method, largely as a contribution to the problem of species. Variations in size and shape of leaves, in weight and volume of fruit, and in number of seeds were tabulated. In *Liriodendron*, *Tulipifera*, *Sanguinaria Canadensis*, and *Ailanthus glandulosa* it was found that variation in size and form is due in part to the persistence of juvenile forms.— J. M. C.

THE GRASSES OF IOWA[10] is the title of a volume prepared by Professors

[6] Biol. Cent. **20** : 625–637. 1900.

[7] On the phloem of Lepidophloios and Lepidodendron. Manchester Memoirs **45** : no. 7. *pls. 2–3*. 1901.

[8] Working list of North American pteridophytes (north of Mexico), together with descriptions of a number of varieties not heretofore published. Utica, N. Y.: Published for the Editor. 1901.

[9] The limits of variation in plants. Proc. Philad. Acad. **53** : 303–319. 1901.

[10] Iowa Geological Survey. Bulletin No. 1. pp. 525, with 220 illustrations. 1901.

L. H. Pammel and J. B. Weems of the Iowa State College of Agriculture, and F. Lamson-Scribner, agrostologist of the U. S. Department of Agriculture. The present volume is general and preliminary, bringing together a large amount of material in reference to the structure of grasses, the purity and vitality of grass seed, cereals, fungus diseases of grasses, bacterial diseases, pastures and meadows of Iowa, weeds of meadows and pastures, chemistry of foods and feeding, and lawns and lawn making in Iowa.—J. M. C.

ERWIN F. SMITH [11] has published the detailed results of his studies of some yellow forms of Pseudomonas. The investigation was very exhaustive, dealing with growth in fluid and solid media, sensitiveness to acids, diastasic action, aerobism, relative nutrient value of carbon compounds, temperature experiments, formation of acids and alkalies, reduction experiments, tests for hydrogen sulfid and nitrites, formation of indol, ferments, pigment studies, nature of the cell wall, vitality, and diagnostic characters. The four species studied, in the order mentioned in the title, are concerned with diseases of hyacinths, cabbages, beans, and sweet corn.—J. M. C.

FRIEDEL [12] claims to have observed the synthesis of carbohydrates, as measured by the absorption of carbon dioxid and emission of oxygen, without the presence of a living organism. Leaves were treated with glycerin under pressure and an extract obtained. A green powder was obtained from leaves heated to a temperature of over 100° C. Upon the exposure of a mixture of the leaf powder and extract to the light, oxygen was given off and carbon dioxid absorbed. Friedel concludes that synthesis is accomplished with or without the presence of living matter by means of a diastase which uses the energy of the solar rays. Chlorophyll is supposed to act as a sensitizer.—H. C. COWLES.

THE SECOND PART of the second volume of the "Catalogue of the African plants collected by Dr. Friedrich Welwitsch in 1853–61," and published by the British Museum, has just appeared. It contains the cryptogams, which have been distributed among investigators as follows: pteridophytes by W. CARRUTHERS; mosses by ANTONY GEPP, including 10 new species and a new genus (*Trachyphyllum*) near Erythrodontium; liverworts by F. STEPHANI, including 7 new species; marine algae by ETHEL S. BARTON; freshwater algae by W. WEST; diatoms by T. COMBER; lichens by E. A. WAINIO, 83 new species being described; fungi by ANNIE L. SMITH; and "Mycetozoa" by ARTHUR LISTER.—J. M. C.

[11] Compt. Rend. **132**: 1138-1140. 1901.

[12] The cultural characters of *Pseudomonas Hyacinthi*, *P. campestris*, *P. Phaseoli*, and *P. Stewarti*, four one-flagellate yellow bacteria parasitic on plants. Bulletin 28 U. S. Department of Agriculture, Division of Vegetable Physiology and Pathology. Pp. 153. August 6, 1901.

A NEW FASCICLE of Urban's *Symbolae Antillanae*[13] has appeared. It contains the conclusion of the monograph of Arthrostylidium by PILGER, 10 species being recognized, 4 of which are new; an enumeration of Gesneriaceae by Urban, including descriptions of 15 new species; a synopsis of Myrsinaceae by MEZ, with a recasting of several genera and descriptions of 11 new species; a synopsis of Theophrastaceae by MEZ, including two new species: descriptions of new species and genera by URBAN, the latter being *Hyptiodaphne* (Thymeleaceae), and three new genera of Compositae, namely, *Tetraperone*, *Koehnela*, and *Notoptera*, all of them Helianthoideae; and descriptions of 10 new liverworts by STEPHANI.—J. M. C.

BY USING an improved apparatus which enabled him to measure quickly and accurately small amounts of CO_2, Kolkwitz[14] has been able to determine that air dry grains of barley containing about 15 per cent. of water, which gradually diminished in the laboratory to 10 or 11 per cent., respired at a rate which produced in 24 hours one-third to one-half a milligram of CO_2 per kilogram of seeds. At 33 per cent. of moisture 2000 milligrams of CO_2 were produced. He also found both embryo and endosperm very tenacious of life. Respiration continued for several hours after such hard treatment as grinding. A full description of the apparatus with figures and an extended account of the investigation will be published in the organ of "Das Institut für Gährungsgewerbe und der Versuchsbrauerie in Berlin."—C. R. B.

TAMMES[15] has made an important investigation on the distribution of carotin. He agrees with most recent authors in identifying carotin with xanthophyll or chlorophyll-yellow and etiolin. Tammes goes somewhat further than most previous investigators in considering practically all red to yellow plastid pigments as carotin. Plastid pigments were examined and found to exhibit carotin tests in green and etiolated leaves, yellow parts of variegated leaves, autumn leaves, flowers, fruits, seeds, diatoms, algæ (green, blue-green, brown, and red), and carrot roots. Carotin always accompanies chlorophyll, appearing before it and remaining after it has gone, and also occurs where chlorophyll is always absent. Carotin is probably more or less efficient in carbohydrate synthesis, as Engelmann has shown. — H. C. COWLES.

HANS HALLIER[16] has presented a somewhat extensive regrouping of angiosperms, taking into account contributions from all departments of

[13] Symbolae Antillanae seu fundamenta florae Indiae occidentalis. Vol. II. Fasc. 3. pp. 337–507. Leipzig: Gebrüder Borntraeger. 1901. *M* 9.90.

[14] Ber. deutsch. bot. Gesell. **19**: 285–287. 1901. [15] Flora **87**: 205–247. 1900.

[16] Ueber die Verwandtschaftsverhältnisse der Tubifloren und Ebenalen, den polyphyletischen Ursprung der Sympetalen und Apetalen, und die Anordnung der Angiospermen überhaupt. Abhandl. Geb. Naturwiss. Verein Hamburg **16**: 1–112. 1901.

botany which may have given suggestions as to possible relationships. In other words, he has abandoned the customary morphological method and has called to his aid anatomy, embryology, physiology, "biology," and plant geography. He regards the Polycarpicae (Ranunculaceae, *et al.*) as the most primitive angiosperms, from which have come all other dicotyledons (especially Amentiferae and Sympetalae) on the one hand, and the monocotyledons on the other. He also thinks that the Convolvulaceae are not to be associated among the Tubiflorae, but are related to the Sapotaceae, Malvaceae, etc., and belong to the Ebenales which originated in the neighborhood of the Anonaceae. A great number of families and alliances are shifted in this way, the details being too numerous to be given in this notice, needing full presentation to be appreciated.—J. M. C.

THE ADDRESS of Dr. B. L. Robinson as retiring president of the Botanical Society of America, entitled "Problems and possibilities of systematic botany," and delivered last August at the Denver meeting, has now been issued as a publication (no. 18) of the Society. The author's summary is as follows: "It may be said that systematic botany is very far from being a completed subject, that from our present standpoint we can see in various directions long vistas of further possibilities for fascinating explorations and profitable discovery, that among the subjects which seem to invite immediate attention the most important are: (1) The determination of the modes and degrees of variation, an investigation which alone can yield data for a more critical discrimination of plant categories; (2) far more complete study of plant ranges, which can scarcely fail to throw much new light upon the forces controlling distribution; and (3) a further examination of plant ontogeny as the most hopeful source of information regarding the more intimate affinities and proper arrangement of plants."—J. M. C.

GIESENHAGEN[17] reports some observations made by him in 1891–2 upon the growth of the rhizoids of Chara, which seem to confirm the recent theories and observations of Haberlandt, Noll, and Němec, on the perceptive organs for geotropic stimuli. When young rhizoids of Chara were directed upward there was first a retardation of their growth, with subsequent recovery of the previous rate, and soon a curvature which directed the tip of the rhizoid again downward. Similar retardation followed the placing of the young rhizoid in a horizontal position and a downward curvature also occurred. Near the tip of the rhizoid Giesenhagen found a group of small granules which altered their position when the rhizoids were displaced, The change in the position of these relative to the sensitive cytoplasm, he regards as producing the immediate stimulation from which curvature results. The nature of these minute granules has not been ascertained, but in this terminal

[17] Ber. deutsch. bot. Gesell. **19**: 277–285. *pl. 12.* 1901.

cell of the rhizoid they seem to play the same rôle as (according to Němec) the starch grains do in the cells of the root tip.—C. R. B.

STRASBURGER [18] has recently investigated the formation of pollen in *Asclepias Cornuti* and *Cynanchum vincetoxicum*, having in view chiefly the reported lack of tetrad formation in some of the Asclepiadaceae. A primary sporogenous cell develops directly into a spore mother cell, as in Malva, Datura, Mentha, and Chrysanthemum, being recognized by the reduction in the number of chromosomes. Each mother cell gives rise to four pollen grains as in other plants, but instead of lying in the usual tetrad form they develop in a row. This leaves the Cyperaceae as the only group known to form only one pollen grain from each mother cell. The row of four microspores is homologized with the row of four potential megaspores commonly produced by the primary sporogenous cell in the nucellus. The regularity in the arrangement of the cells and the homogeneity of the protoplasm invited a search for centrosomes, but none were found. The author, while not denying the existence of centrosomes in the higher plants, expresses an increasing doubt as to the possibility of making such structures visible with the present methods.—T. C. FRYE.

FREDERICK H. BILLINGS [19] has examined a number of species of several large families of spermatophytes to see whether the seed development, especially the changes of the embryo sac and integuments after fertilization, can be used as a basis of classification. Taking plant groups as now recognized, in some he finds marked resemblances. For example, in all species of Campanulaceae, Lobeliaceae, and Stylidaceae he finds "haustoria" (outgrowths from the embryo sac) at both chalazal and micropylar ends, and these are supplied with nuclei from the endosperm. The antipodal ones break down, but may divide first; while in Calendula the micropylar haustorium is said to be under the control of the persistent synergid, which grows into it. The various kinds of haustoria are described in detail. In some cases the embryo sac is constricted, the upper chamber containing the embryo, the lower becoming filled with tissue. In other cases finger-like processes put out from the side or base of the sac, reaching towards the region of vascular bundles. The author's reason for assigning a nutritive function to the "haustorium" regions is simply the active appearance and staining power of the nuclei. His conclusions are that in doubtful cases the nature of the embryo sac, the thickness of the integument, etc., may help to settle the systematic position of a genus or species.—FLORENCE MAY LYON.

[18] Einige Bemerkungen zu der Pollenbildung bei Asclepias. Ber. deutsch. bot. Gesell. **19**: 450–461. *pl. 24*. 1901.

[19] Beiträge zur Kenntniss der Samenentwickelung. Flora **88**: 253–318. 1901.

A PAPER ON *Tulipa Gesneriana* by Alfred Ernst[20] adds another species to the list of seed plants showing polyembryony, and also confirms Guignard's observation of double fertilization in this species. The author has followed out the development of the embryo sac in a close series, discovering no marked variation from the usual method. In fertilization the second male nucleus unites with the upper polar nucleus and both unite with the lower polar, the three remaining distinct and showing no evidence of fusion. The interest of the paper, however, centers about the development of the embryo. The fertilized egg divides by a longitudinal or transverse wall, and sometimes by an oblique wall. From these cells there develops by means of irregular cell division a compact mass of large cells rich in protoplasm and containing many nuclei. This "proembryo" forms at its apex from one to six embryos, only one of which as a rule develops into a normal embryo. The other embryos, as well as the cells of the "proembryo," are resorbed and devoted to the building up of the embryo proper. This is a case of polyembryony similar to that discovered by Jeffrey and also by Hofmeister in Erythronium. The author endeavors to follow out the reduction and doubling of the chromosomes, but this part of the paper is far from satisfactory. A valuable résumé of the literature of polyembryony is included in the discussion. The figures are carefully drawn and adequate to explain the points considered.—J. B. OVERTON.

ITEMS OF TAXONOMIC INTEREST are as follows: C. R. BALL (Proc. Iowa Acad. Sci. 7: 141–154. 1900) has published an account of the 14 species of Salix occurring in Iowa.— E. S. STEELE (Proc. Biol. Soc. Washington 14: 47–86. 1901) has published the 6th list of additions to the flora of Washington, D. C., and vicinity, with descriptions of new species of Viola and Lycopus.— F. N. WILLIAMS (Jour. Bot. 39: 289–294, *pl. 425*. 1901) has separated Salisbury's genus Ianthe from Hypoxis.— F. V. COVILLE (Proc. Wash. Acad. Sci. 3: 297–362. *pls. 33–42*. 1901) has published a very full and handsomely illustrated account of the willows of Alaska, including 23 species, one of which is new.— ELIAS NELSON (Proc. U. S. Nat. Mus. 23: 697–713. 1901) has published a revision of 35 species of Antennaria, 4 of them being new.— K. FR. MEINSHAUSEN (Acta Hort. Petrop. 18: 9–415. 1901) has published a synopsis of the Cyperaceae of European and Asiatic Russia. New species are described under Kyllingia (1), Cyperus (3), Scirpus (5, including Eleocharis), Eriophorum (2), Schoenus (1), Kobresia (2), and Carex (25), the last genus being represented by 215 species.—V. L. KOMAROV (*idem* 419–449) has described numerous new species from Manchuria and northern Korea, among them a new genus (*Boehmeriopsis*) of Urticaceae and 9 new species of Carex.— O. F. COOK (Bull. Torr. Bot. Club 28: 525–569. *pls. 43–48*. 1901)

[20] Beiträge zur Kenntniss der Entwickelung des Embryosackes und des Embryo (Polyembryonie) von *Tulipa Gesneriana*. Flora 88: 37–77. *pls. 4–8*. 1901.

has published a synopsis of the palms of Porto Rico, including 20 species, representing 14 genera and 4 families. The startling fact is that 7 of the genera and 13 of the species are new. *Inodes*, *Thrincoma*, and *Thringis* are new genera of Sabalaceae; *Aeria* and *Acrista* of Arecaceae; *Curima* and *Cocops* of Cocaceae. The plates are of unusual beauty.—E. P. BICKNELL (*idem* 570–592), in his ninth paper entitled "Studies in Sisyrinchium," presents the species of Texas and the southwest, the number reaching 25, of which 17 are new.—J. M. C.

NABOKICH in a preliminary communication to the German Botanical Society[21] claims to have demonstrated that the growth of the higher plants may take place under conditions which prevent normal respiration, and that the reason why previous investigators have found no anaerobic growth is that their experiments were carried on under conditions which permitted the wilting of the experimental material. His method consists in putting into a 50–70^{cc} flask with tubulated neck, 40–50^{cc} of a 0.5 to 2 per cent. solution of glucose or cane sugar. Into this nutritive solution he puts etiolated seedlings of maize, sunflower, onion, etc., or cuttings of vigorous stems and roots which have been kept previously in water for one to four hours. The parts are marked with fine lines to serve as data for growth. After putting these into the flask, the top of the neck is fused off, and after cooling the air is exhausted *via* the side tube, which is previously drawn down at one point to a thick capillary. After exhaustion to a minimum the flask is partly sunk in hot water. The nutritive solution boils violently and the escaping vapor aided by the continued exhaustion with the air pump removes the last trace of oxygen. Five to eight minutes suffice to remove the oxygen and the side tube is then fused off. The whole operation should be complete in a half to three quarters of an hour. Seedlings of maize showed 7.5^{mm} growth in 36 hours, cuttings from the stem of maize 8.2^{mm}, and cuttings of stem of sunflower 5^{mm} in 45 hours. In various seedlings curvatures developed which are precisely similar to those which are formed in the air under similar stimuli. No formation of chlorophyll was observed.

These results stand in sharp contradiction to those of most observers, whose source of error Nabokich undertakes to specify. In a later number of the same periodical Wieler replies to Nabokich's strictures and maintains the accuracy of his own results. The question evidently needs further investigation.—C. R. B.

MISS MARGARET C. FERGUSON[22] has published the results of her studies in Pinus. A detailed account of spermatogenesis in five species is given,

[21] Ber. deutcsh. bot. Gessell. **19**: 222–236. 1901.

[22] The development of the pollen tube and the division of the generative nucleus in certain species of pines. Ann. Bot. **15**: 193–223. *pls. 12–14*. 1901.

The development of the egg and fertilization in *Pinus Strobus*. *Ibid.* 435–479. *pls. 23–25*.

and of oogenesis, the phenomena of fertilization, and the early segmentations in *P. Strobus*. In the main, there is abundant confirmation of the more fragmentary work of previous investigators. Besides, the genus has been found variable enough to make the full study of any species valuable. Some of the points to be noted are as follows: The "antheridial" (generative) cell is said to divide "before the beginning of winter," which indicates a wide range of time in the genus for this event. A definite order of precedence for the stalk and "generative" (body) cells in the pollen tube is given, the former being said to pass the latter and consort with the "vegetative" (tube) nucleus. The body cell is said to be peculiar in never being limited by a cell wall, and a survival of the centrosome is suggested in the division of its nucleus. The interesting claim is made that "sperm cells are never formed, but the sperm nuclei remain surrounded by a common mass of cytoplasm," and become unequal very early in their history. In some cases, after fertilization, the tube and smaller sperm nuclei were observed to divide amitotically. The most interesting fact in connection with fertilization and segmentation is that in addition to the well-known fact that there is no real fusion of the sexual nuclei in fertilization, the author has been able to observe that "the two chromatic groups remain distinct until the nuclear plate stage" of the first segmentation. No centrosomes are claimed for the first segmentation, "but the entire activity connected with this mitosis indicates that the sperm nucleus, under the influence of the egg cytoplasm, is the agent which initiates and controls the division." The frequently noted similarity between the fertilization processes in the gymnosperms and animals is presented in considerable detail. These papers are valuable additions to our rapidly increasing literature of gymnosperms.—J. M. C.